Building Next Generation Datacenter Networks

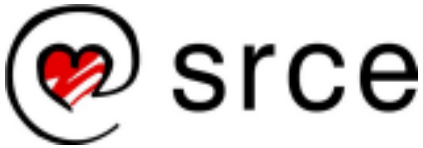
Boris Germashev

Regional Director

Eastern & Central Europe, CIS, Russia

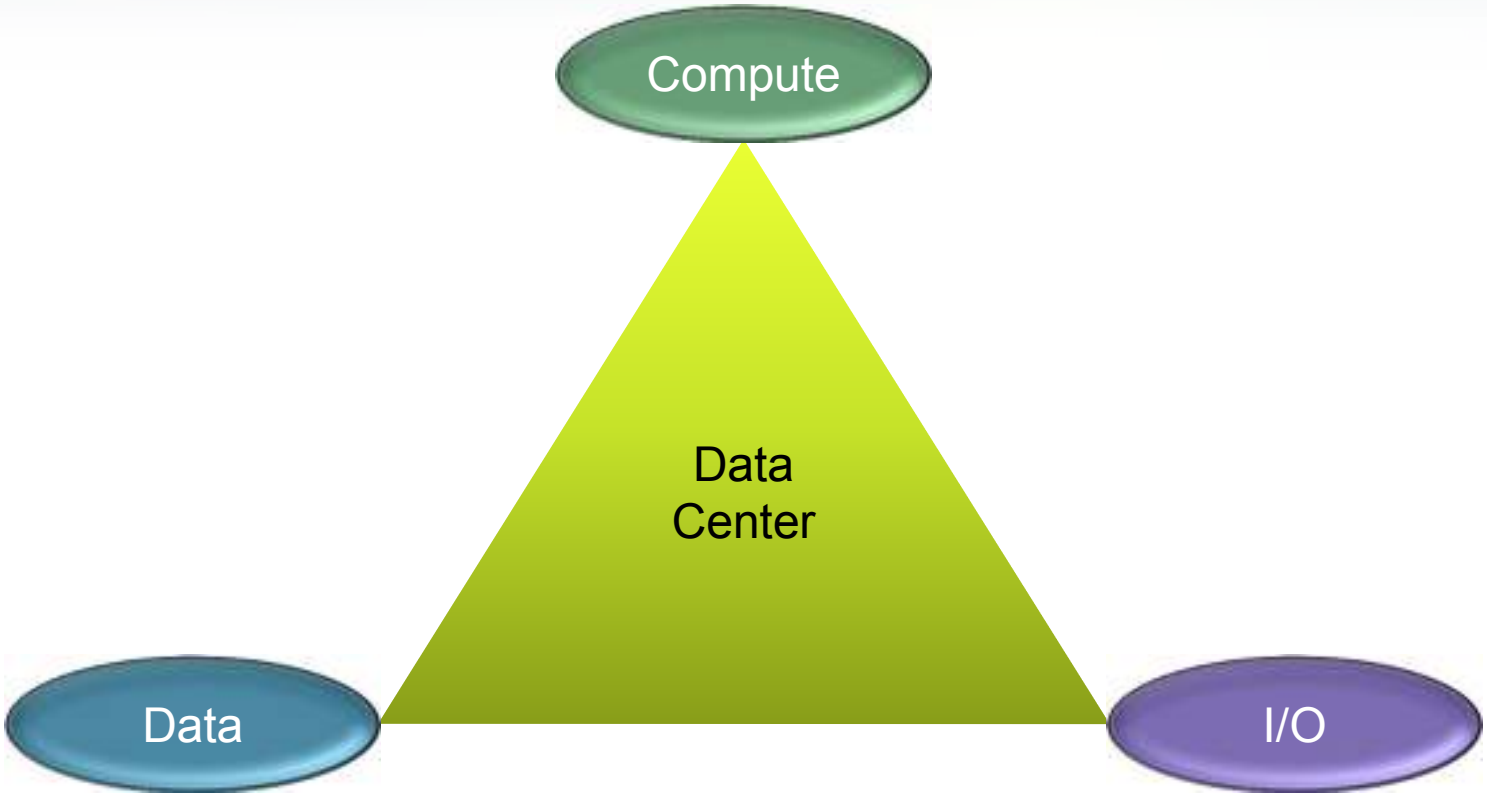
Hvala!

- Our customer SRCE and our partner S&T for proving this opportunity!



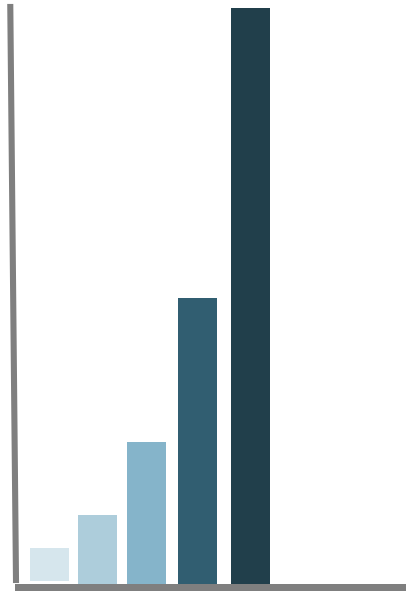
extreme networks

Three Corners of the Data Center Triangle



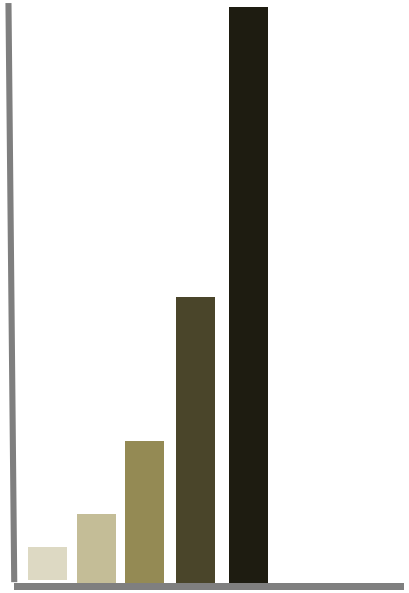
Moore's Law For Data Centers

Compute



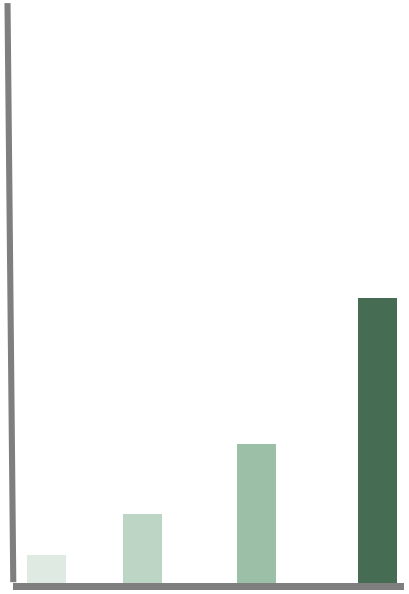
Doubles Every 1.5 Years

Data



Doubles Every 1.5 Years

I/O



Doubles Every 4 Years

View from Open Networking Foundation (ONF)

- The Need for a New Network Architecture
  - Changing traffic patterns
  - The “consumerization of IT”
  - The rise of cloud services
  - “Big data” means more bandwidth
- Limitations of Current Networking Technologies
  - Complexity that leads to stasis
  - Inconsistent policies
  - Inability to scale
  - Vendor dependence
- ONF touches two major topics
  - Scalability
  - Flexibility/automation

Software-Defined Networking:
The New Norm for Networks

ONF White Paper
April 13, 2012

The SDN Model

Separate Control/Management Plane from Data/Forwarding Plane

Centralize Network Intelligence and State

Abstract Network Infrastructure from Applications

Make the Control and Management Plane Programmable

Network Technology to Meet Future Demand

Scalable

- Bandwidth aggregation to multiply I/O
- Seamless migration to higher speeds and feeds

Flexible

- I/O diversity and mix-n-match
- Auto-provisioning and configuration

Economical

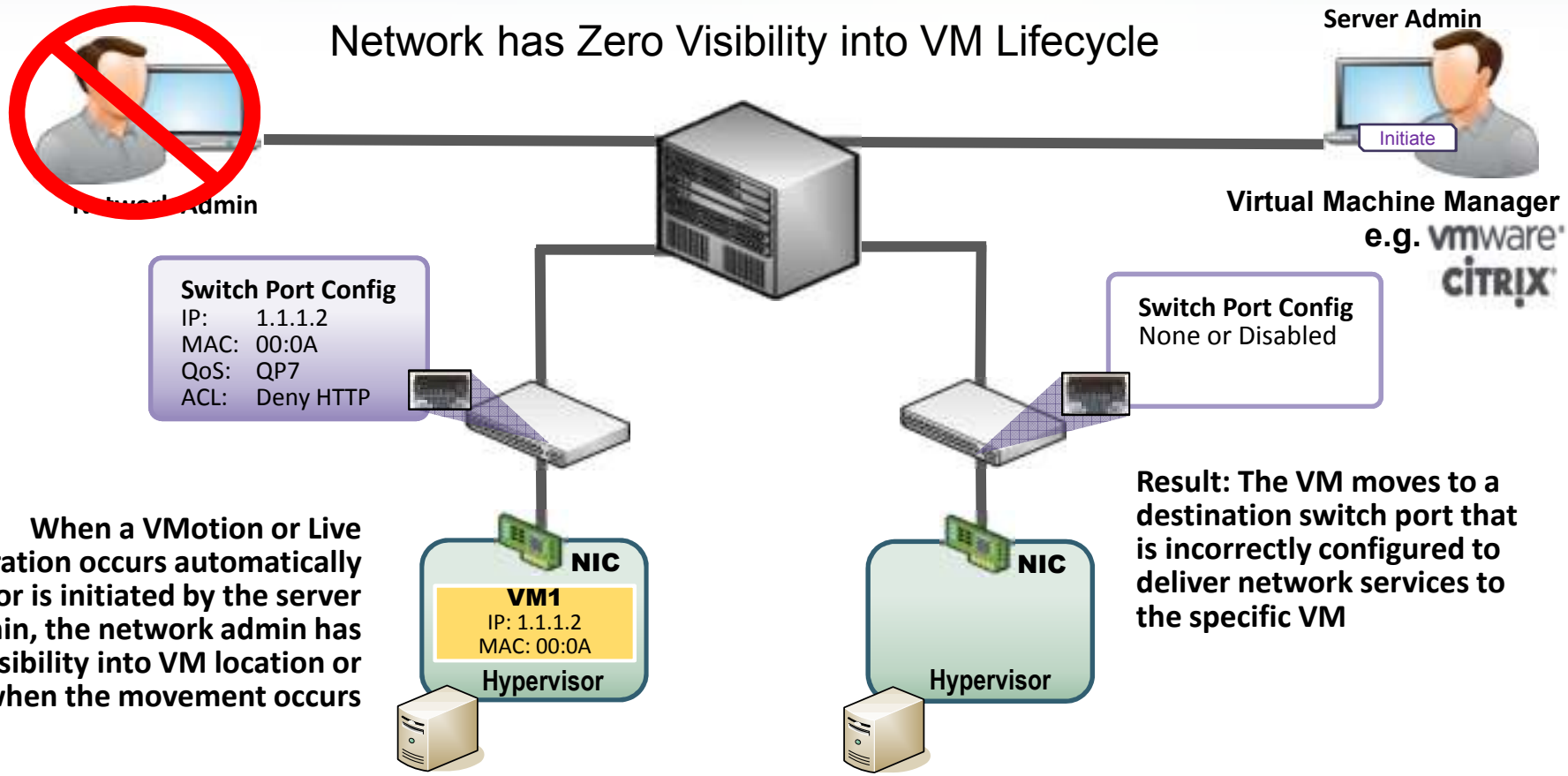
- Minimal cost increase with speed migrations
- Reusable in terms of infrastructure and training

Reliable

- Is resilient and time tested
- Provides required level of service up time

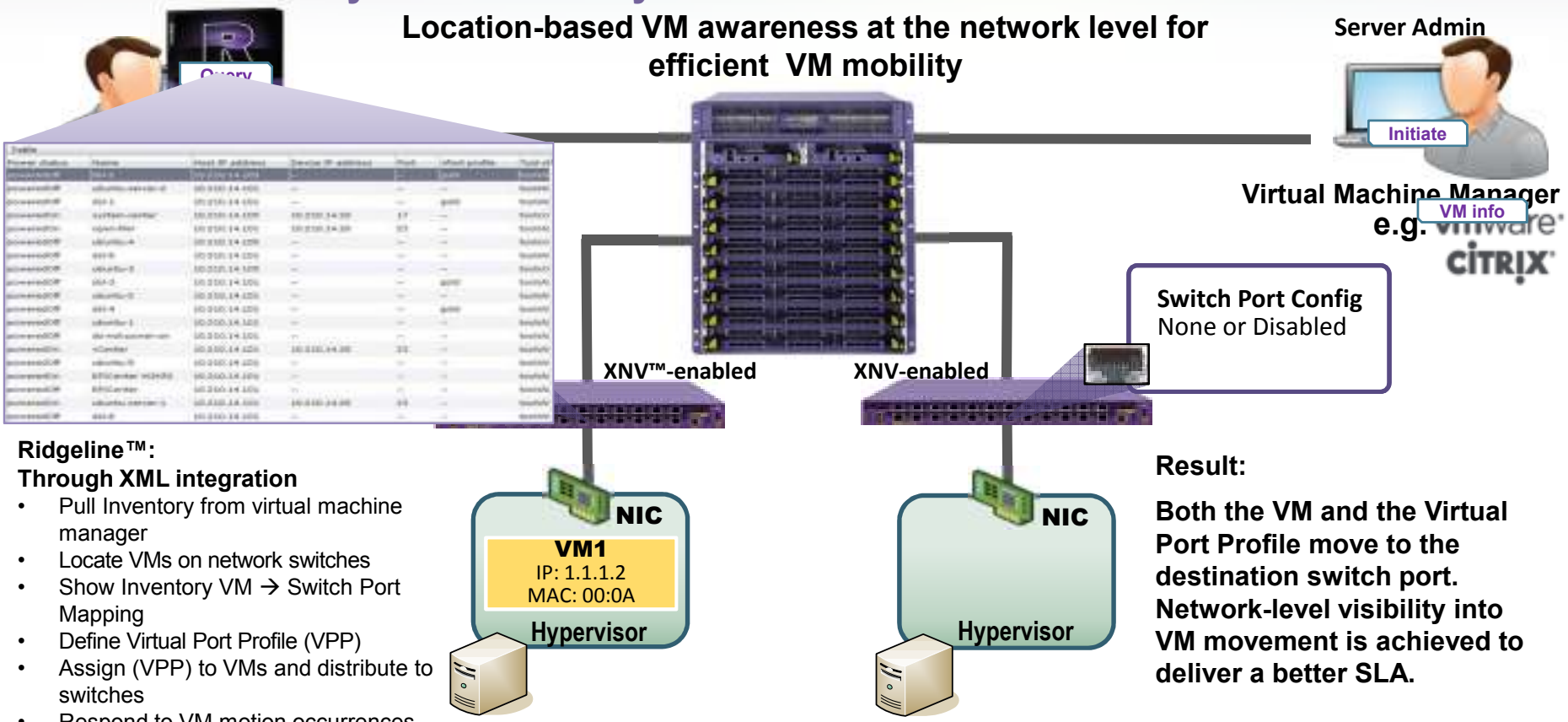
extreme networks

Example of "Complexity which leads to stasis"
VM Mobility Issues Today


Network has Zero Visibility into VM Lifecycle
Server Admin
Initiate
Virtual Machine Manager
e.g. vmware
CITRIX
Switch Port Config
IP: 1.1.1.2
MAC: 00:0A
QoS: QP7
ACL: Deny HTTP
Switch Port Config
None or Disabled
When a VMotion or Live Migration occurs automatically or is initiated by the server admin, the network admin has NO visibility into VM location or when the movement occurs
NIC
VM1
IP: 1.1.1.2
MAC: 00:0A
Hypervisor
NIC
Hypervisor
Result: The VM moves to a destination switch port that is incorrectly configured to deliver network services to the specific VM

Example of a "Network Application"
Extreme Networks XNV – VM Lifecycle Management

Network Visibility into VM Lifecycle



Ridgeline™:
Through XML integration

- Pull Inventory from virtual machine manager
- Locate VMs on network switches
- Show Inventory VM → Switch Port Mapping
- Define Virtual Port Profile (VPP)
- Assign (VPP) to VMs and distribute to switches
- Respond to VM motion occurrences

Result:

Both the VM and the Virtual Port Profile move to the destination switch port. Network-level visibility into VM movement is achieved to deliver a better SLA.

How is it related to SDN?

Proactive Dynamic Networks

Static	Dynamic
Limited visibility of User, Device, Location, and Presence	Awareness of User, Device, Location, and Presence
Network provisioning and monitoring based on:	Network provisioning and monitoring based on:
• IP Address • TCP/UDP Port Information • Static ACLs	• User Identity, Device Identity • Virtual Machine Identity • Role-based Access, Dynamic ACLs
Manual Configuration	Automated Configuration

Reactive Management → **Proactive Management**

Enabling the Move from a Static Network to a **Dynamic Network**

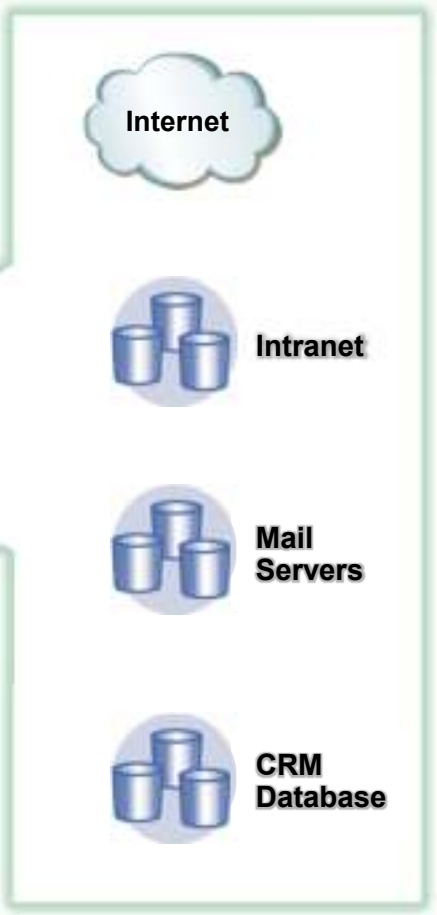
extreme networks

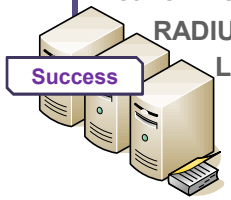
Transparent Authentication with AD Login

Username	IP	MAC	Computer Name	VLAN	Location Switch Port #
John_Smith	**10.1.1.101**	**00:00:00:00:01**	**Laptop_1011**	**1**	**24**

User and Device Awareness through Transparent Authentication

- No software agents required – utilize existing authentication methods
- Do not need to retrain users on logging on to the network





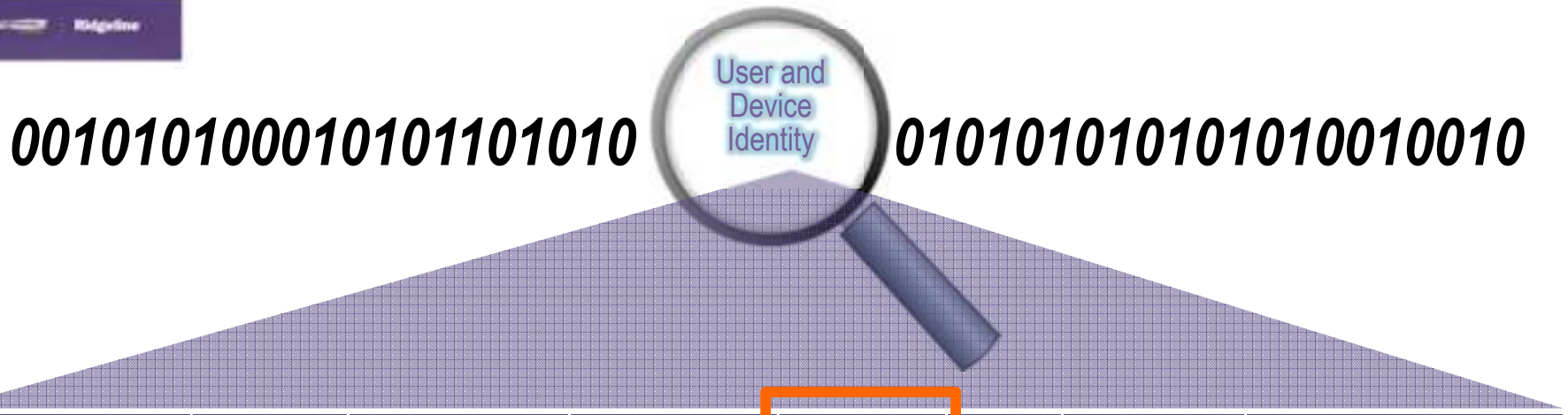
Active Directory Server
RADIUS Server
LDAP Server

1. User logs into the Active Directory domain with user name and password
2. ExtremeXOS® network "snoops" the Kerberos login by capturing the user name
3. Active Directory validates and approves user credentials and responds to host
4. ExtremeXOS grants network access based on AD server response

Why does it matter for the DC?

Role-based Access

Turning bits and bytes of information into “rich content” (users, devices, and their location) and achieving automatic provisioning with ***Role-based Policies***



Username Device Identity	IP	MAC	Computer Name	Role	VLAN	Location Switch Port #	Location Switch Location
John_Smith	10.1.1.101	00:00:00:00:00:01	John’s_Laptop	Employee	1	24	Wiring closet, building 2
Alice_Jones	10.1.1.200	00:00:00:00:00:02	Science_PC	Contractor	1	1	3rd floor, building 3
Cisco VoIP Phone	10.1.2.100	00:00:00:00:00:03	n/a	Voice	10	2	3rd floor, building 4
Dell iSCSI_Array	10.3.1.111	00:00:22:00:00:10	n/a	Storage	20	8	Data Center
<unknown>	10.1.1.50	00:00:00:00:00:50	n/a	Guest	1	1	Media building

Differentiator: The Power of ExtremeXOS®

Resilient and Proven

- Modular
- Adaptable Across Platforms
- Predictable Performance
- Memory Protected

Intelligent and Personalized

- Virtualization
- Loadable Modules
- Scripting and Open Interfaces
- Distributed Policies

The Power and Service Predictability of A Single OS

From Service Provider, Through The Enterprise Edge
And Core, And Into The Data Center

Extreme Networks Open Fabric and SDN

SDN Applications

- VM Lifecycle Management (XNV)
- User Identity Management (IDM)
- Bring Your Own Device (BYOD)
- Application Performance Management
- Collaborative Programming (XKIT)

Centralized Management/Orchestration Platform

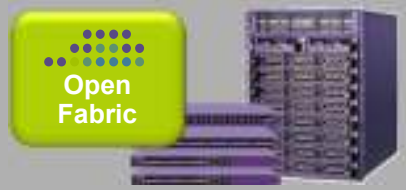
- Ridgeline
- OpenFlow
- openstack

EXOS – Extensible, Open, Secure Network OS

- XML
- Scripts
- External App SDK
- OpenStack Quantum Plugin
- OpenFlow
- Modular
- Predictable Performance
- Memory Protected
- Hardware Abstracted

High Performance Converged Open Fabric

- Low Latency
- High Capacity
- MLAG
- DCB

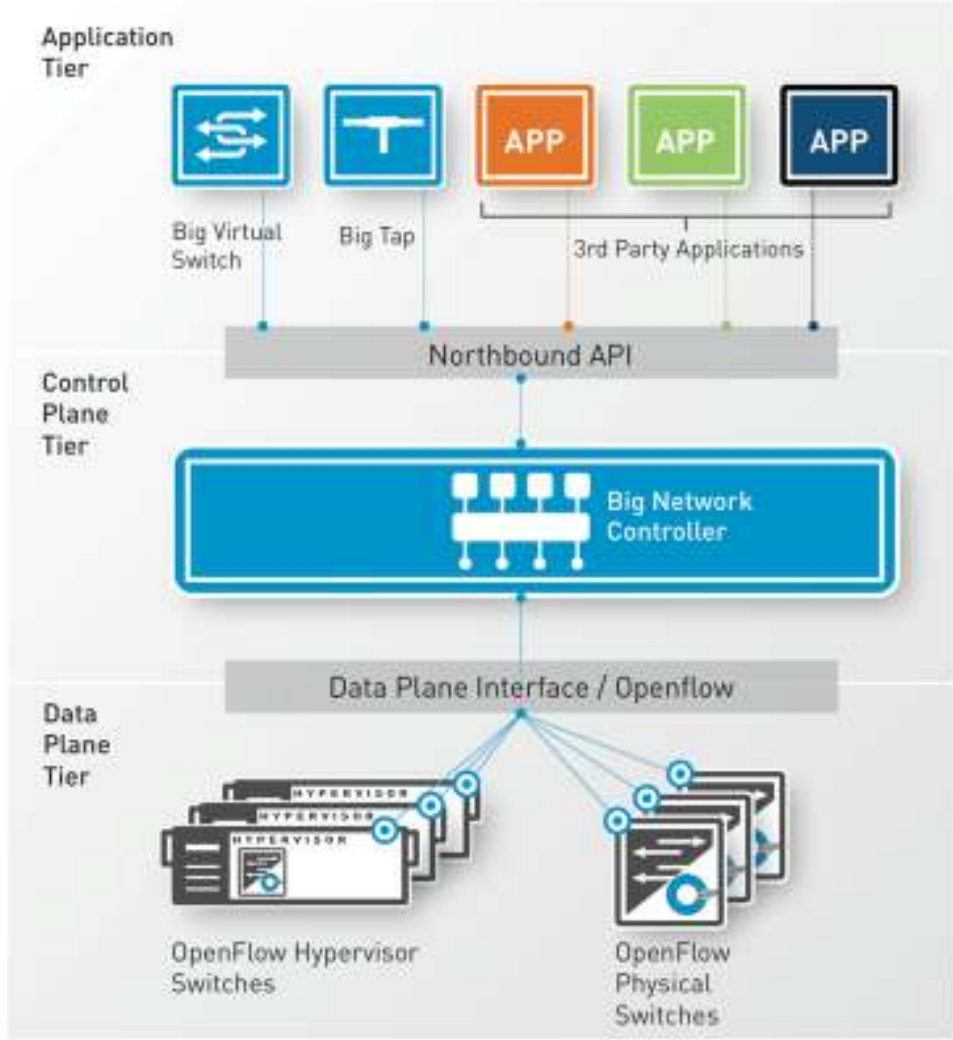


xKit: XOS Extensibility and Tools

Crowd-Sourced Knowledge Base to Empower IT

New SDN Applications from Big Switch

- Supported by Extreme Networks
- Tested interoperability of Extreme Networks switches and Big Network Controller
- **Big Tap** delivers traffic monitoring and dynamic network visibility with flow filtering.
- **Big Virtual Switch** virtualizes the network - provisions the physical network into multiple logical networks from Layer 2 to Layer 7.



Flexibility of SDN requires new level of scalability

- Each flow can have a lot of attributes
  - This gives the flexibility
  - And yet requires to store hundreds thousands of flow in hardware by the network switches!
- Extreme Networks does this for years with ExtremeXOS!

FIGURE 2
Example of OpenFlow Instruction Set

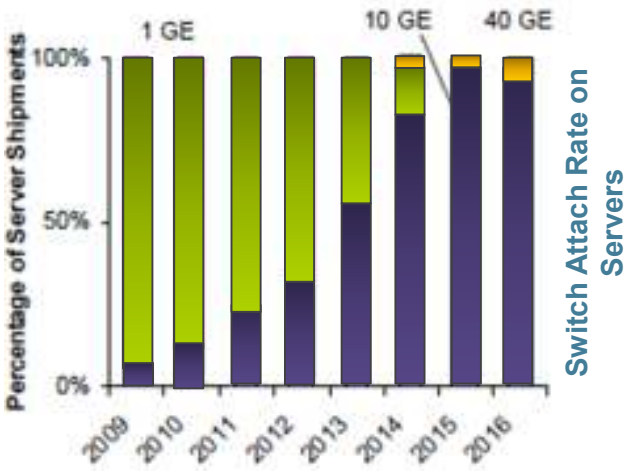
OpenFlow-enabled Network Device

Flow Table comparable to an instruction set

MAC src	MAC dst	IP Src	IP Dst	TCP dport	...	Action	Count
*	10:20:.	*	*	*	*	port 1	250
*	*	*	5.6.7.8	*	*	port 2	300
*	*	*	*	25	*	drop	892
*	*	*	192.*	*	*	local	120
*	*	*	*	*	*	controller	11

Network to support SDN

High Density 10 GbE Server Migration



2x
Server Bandwidth

15%
Infrastructure Costs

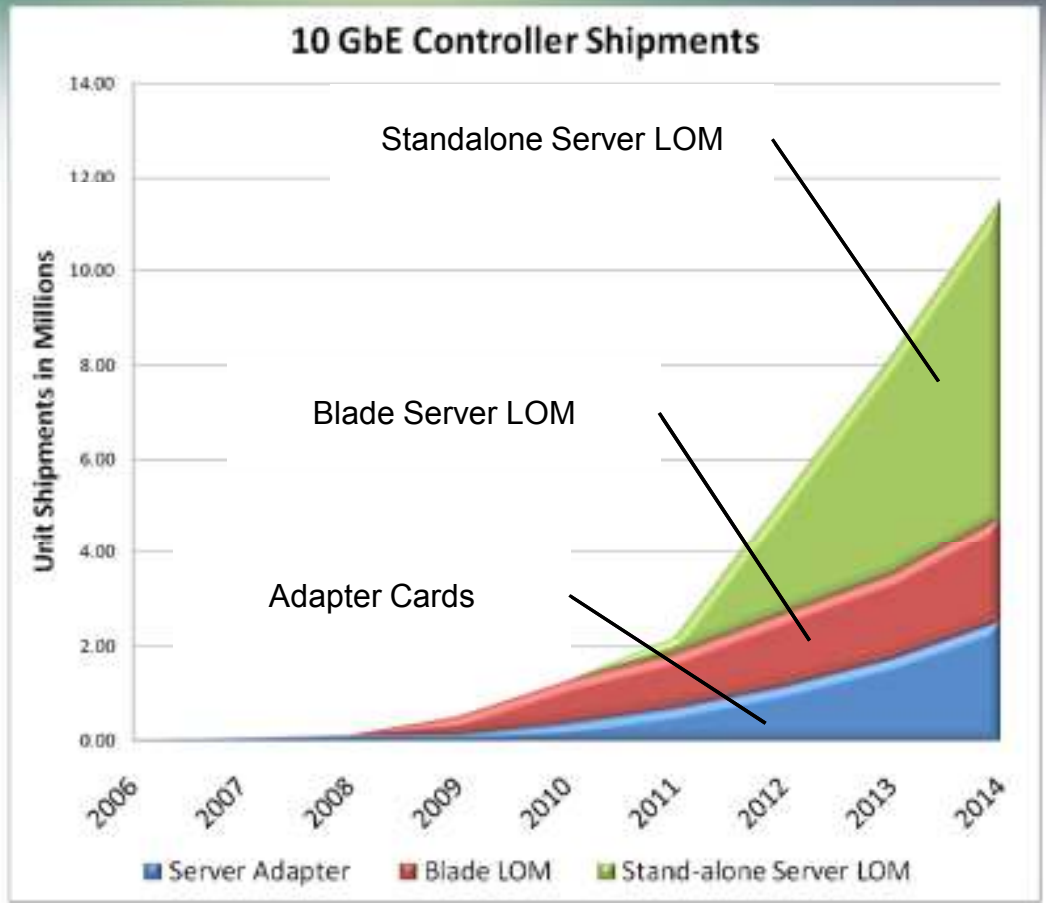
45%
Power per Rack

80%
Cables and Switch ports

Source: Dell'Oro, 2011

Dell'Oro 10GbE Forecast

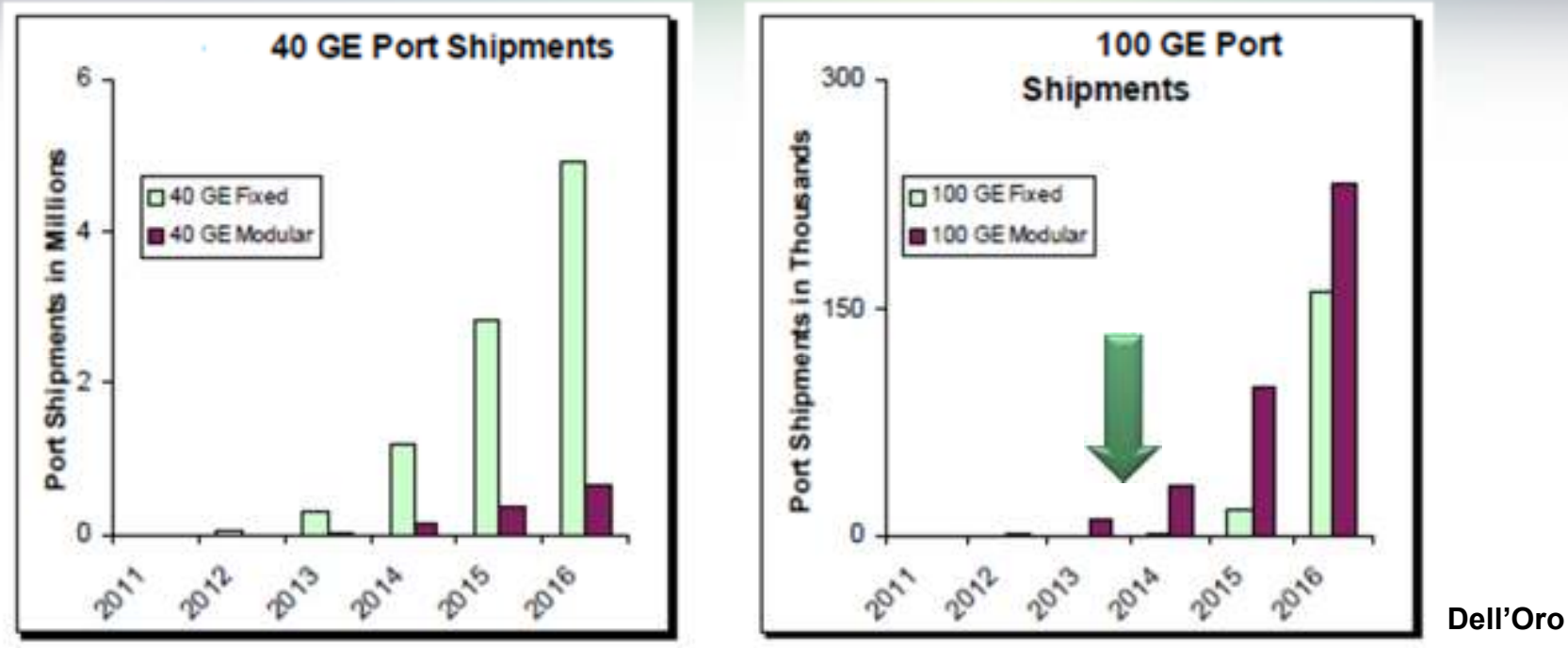
- RJ-45 10Gbit Ethernet!



Two Factors Driving Dell'Oro Forecast

- Increased IT spending
- Rapid integration of Blade LOM

40 and 100G Market Evolution

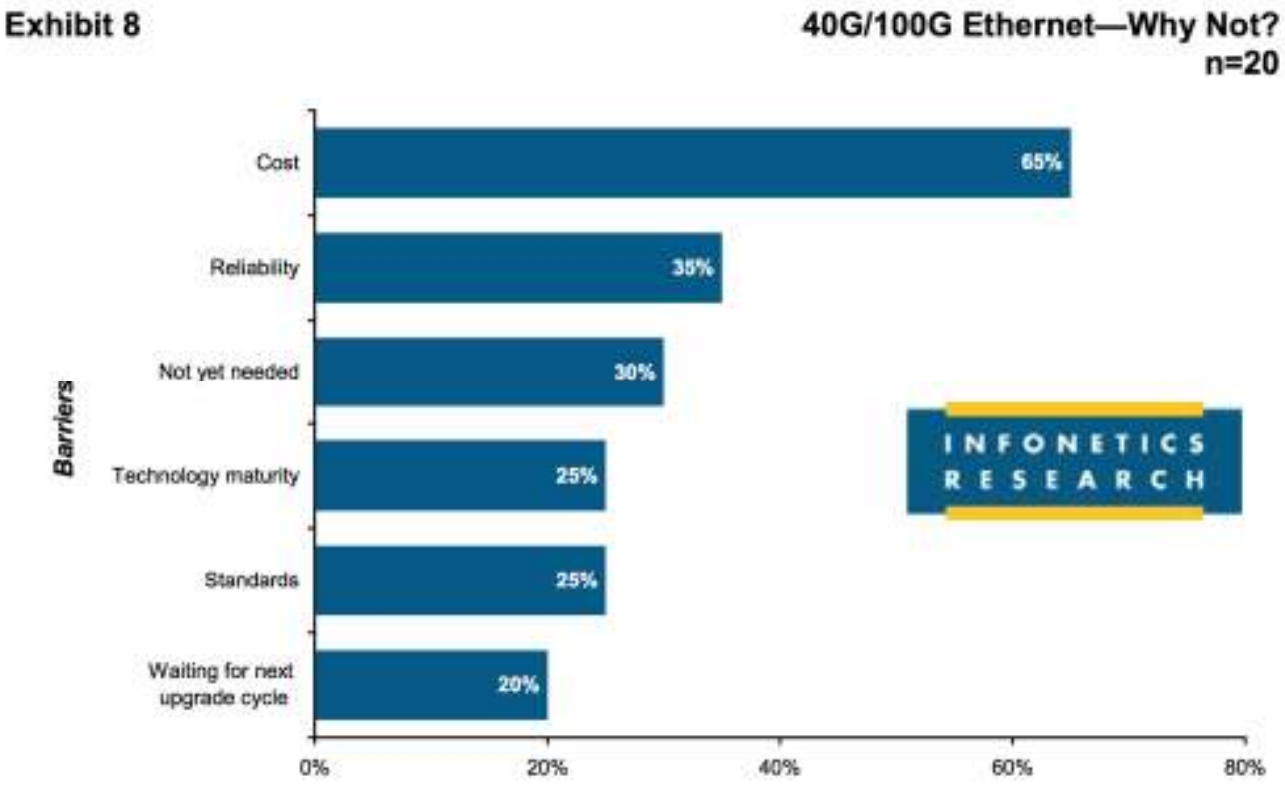


Dell'Oro

- Initial adoption of 100GbE was limited to Service Provider and Internet Exchange Points.
- In Data Centers, 100GbE adoption will depend on relative cost-per-port and 40GbE adoption on the server side.
  - 40GbE server access will start gaining traction after 2014, driving 40GbE port volume
  - 40GbE for aggregation will grow
  - CFP2 in 2H 2013 drives inflection point in 100GbE cost-per-port and density
- Catalyst for data center 100GbE deployment

Barriers for wide adoption of 40G/100G
Source: Infonetics Research, 9-Nov 2012

- Cost
- Reliability of new physical components (especially optics)



Extensive Portfolio for Wired and Wireless Networks

SDN is supported across all families of Extreme Networks Switches!

BlackDiamond X8 - Introduction

Highest Consolidation
- 14.5 RU - 1/3rd of Rack
- 768 x 1/10G wire-speed
- 192 x 40G wire-speed
- High-Density 100G

Unmatched Performance
- 20 Tbps Capacity/Switch
- 2.56 Tbps Bandwidth/Slot
- 30.5 Bpps Throughput
- 1 Million L2/L3 Scale

High Availability
- 1+1 Management
- N+1 Fabric, Power & Fan
- N+N Power Grid
- EAPS, LAG, VRRP

Ultra-Low Latency
- 2.3 uSec – Unicast*
- 2.4 uSec – Multicast*

End-to-End Virtualization
- 128K Virtual Machines
- VM Lifecycle Management
- VEPA, VPP, XNV™
- VR, MLAG, VPLS

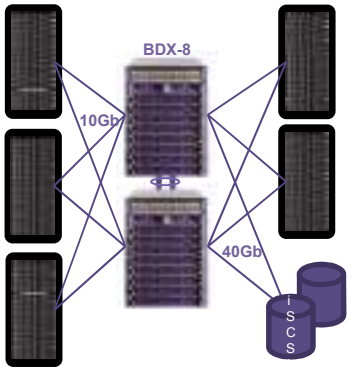
Full Convergence
- iSCSI, NFS, CIFS
- DCBx (PFC, FS, ETS)
- FCoE Transit
- FC SAN Connectivity**

Lowest TCO
- Front-to-Back Cooling
- Variable Fan Speed
- 5.6W per 10GbE port*
- Intelligent Power Mgmt.

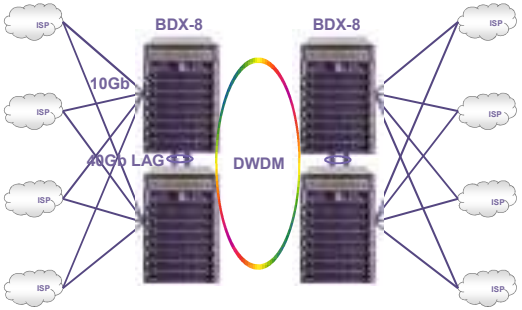
* Based on Lippis Test Report
** Through QLogic UA5900

BlackDiamond X8 in Different Data Center Verticals

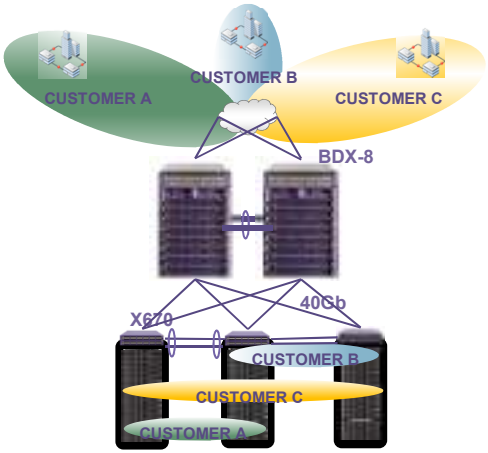
High Performance Computing



Internet Exchange Points



Virtualized Multi-Tenant



PetroChina

LINX

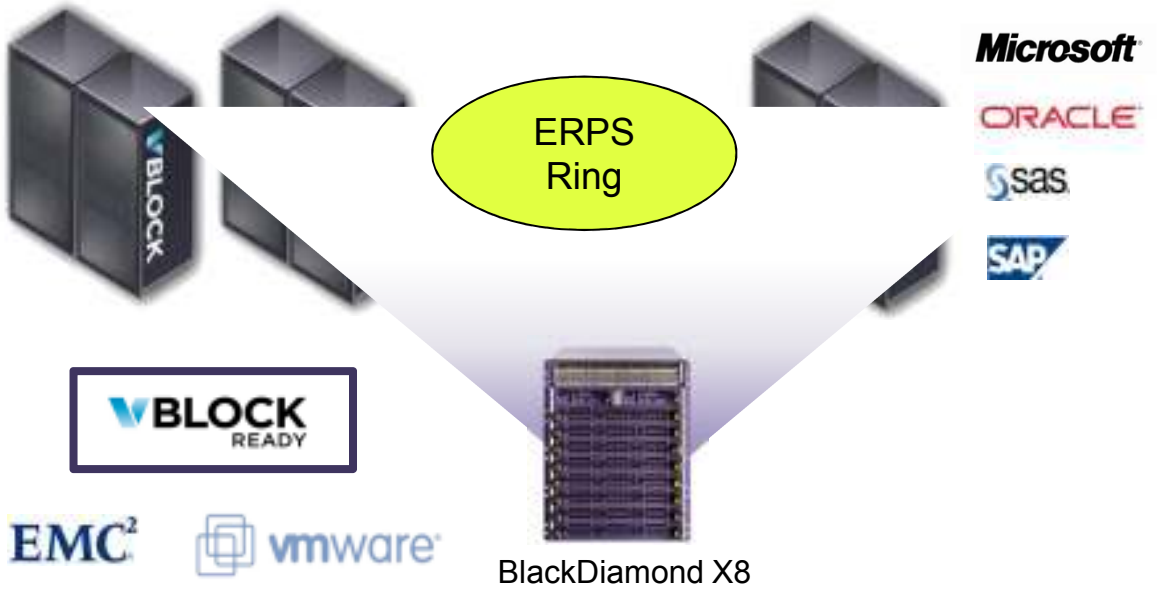
Deutsche Telekom

extreme networks

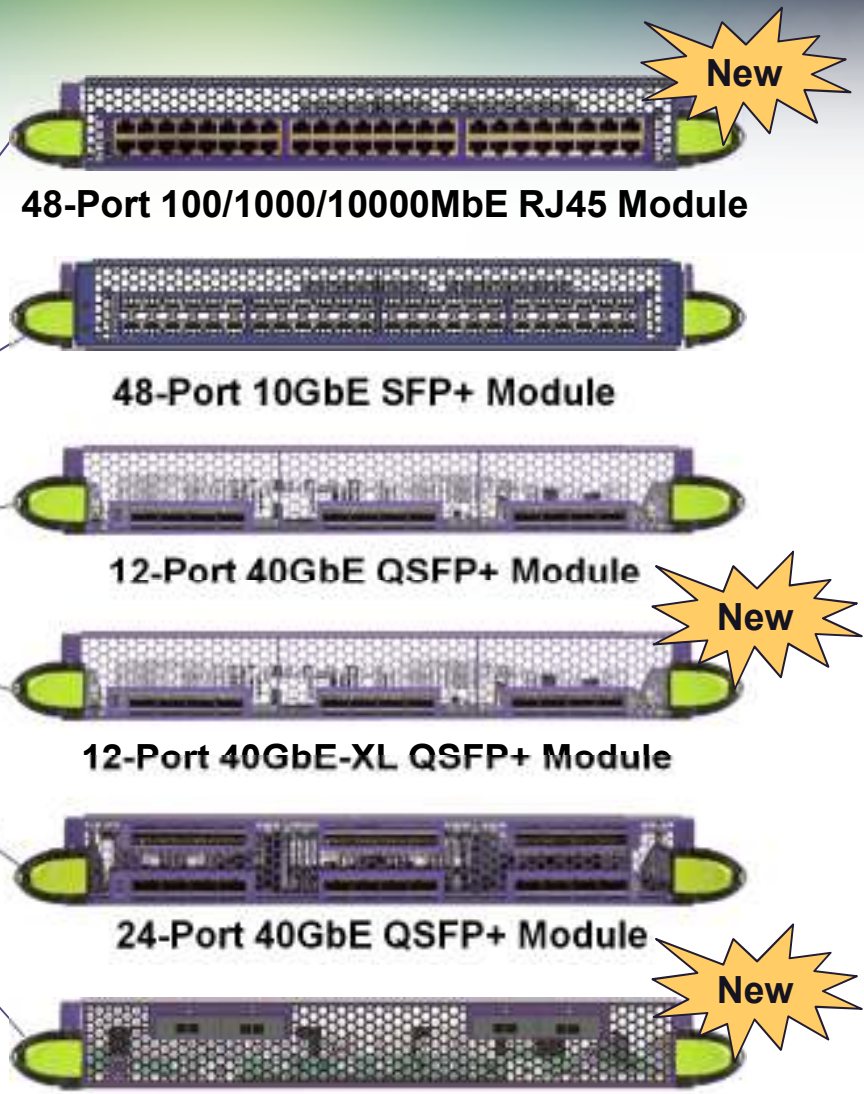
VBLOCK & Extreme for DR & Avoidance

- Ring-Based Interconnect between VBlocks within a Data Center as a High-Speed Bus
- Ethernet Replication Over Ring Protection (ERPS) for Business Continuity and Disaster Recovery

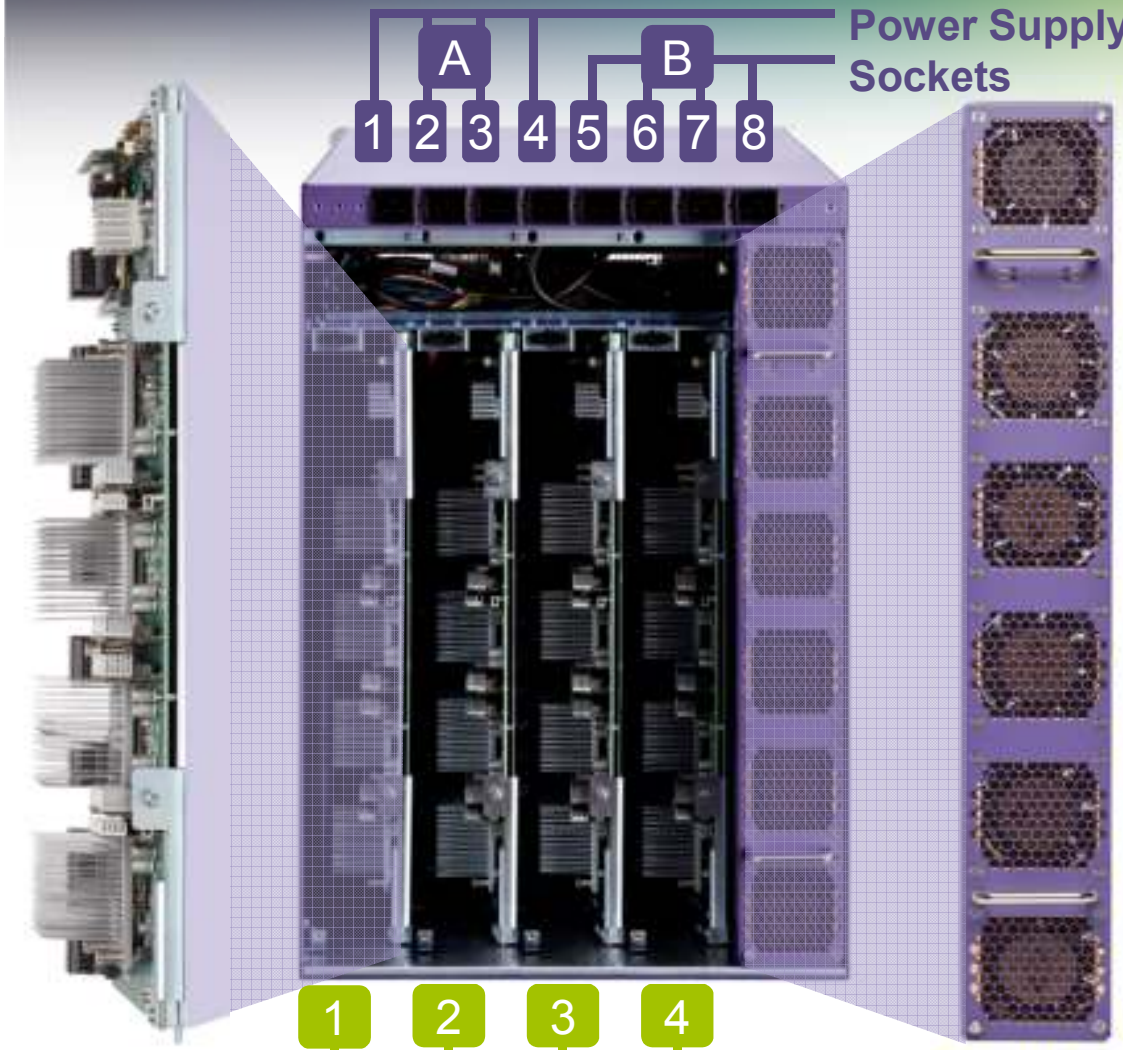
  - Commoditizing 100% Application Availability
    - 10Gb Ethernet costs
  - Simplifying Data Center Network
    - True convergence without DCB/FCoE
  - Extending the Metro Data Center over Ethernet
    - Much lower cost



High Performance Open Fabric - BlackDiamond X8



BlackDiamond X8 Chassis – Rear Open



Rear Configuration

- 4 Fabric slots
- 5 Fan Tray slots
- 8 Power Supply sockets

Fabric Modules

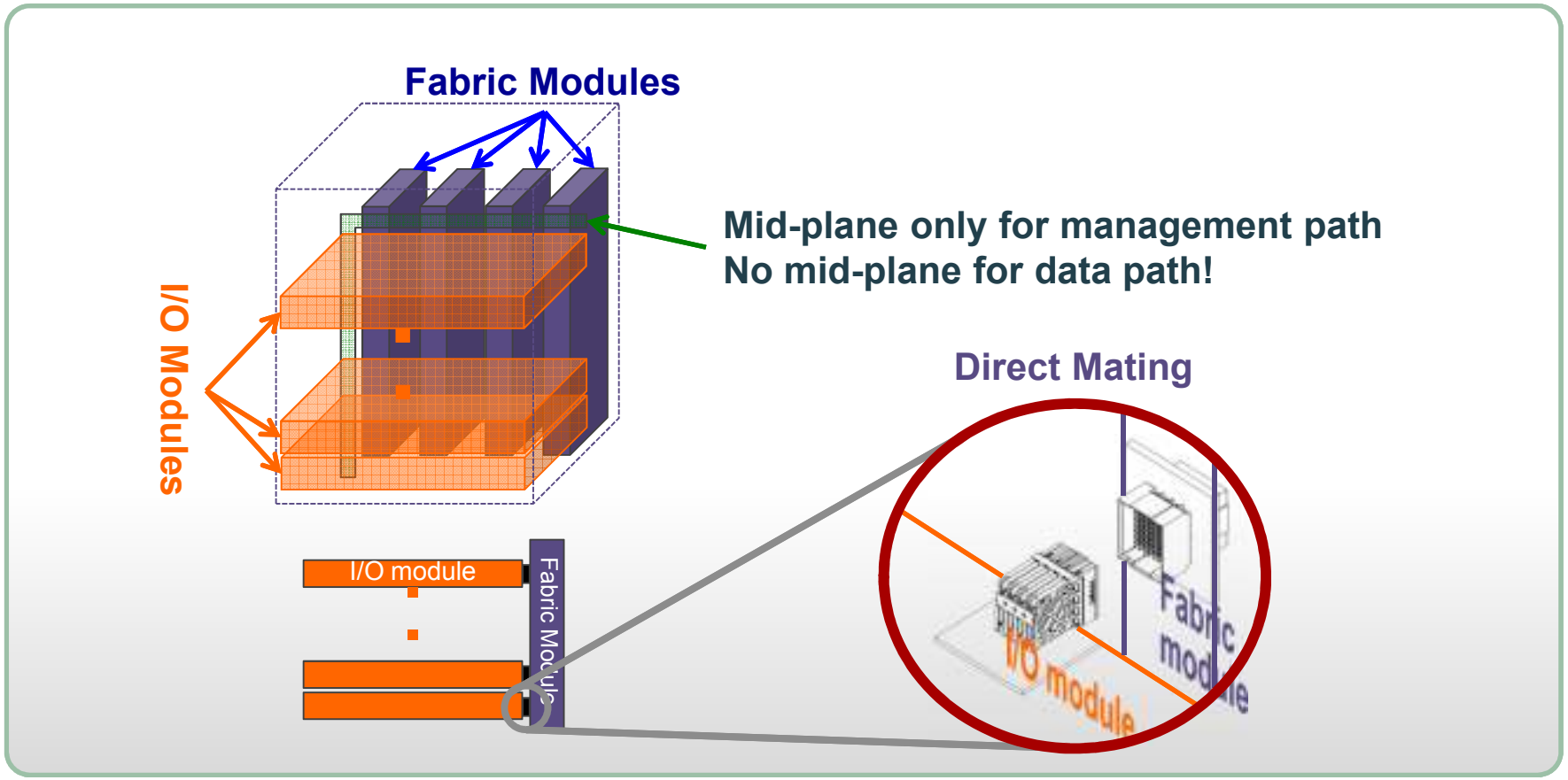
- Orthogonal direct coupling
- 3+1 Switch Fabric Modules
- 20.48Tbps switching capacity
- 2.56Tbps bandwidth per slot

Fan Trays

- 4+1 Fan Trays
- 5+1 fans per tray
- Variable fan speed control
- Front-to-back airflow pull

Density to Performance Proportionality

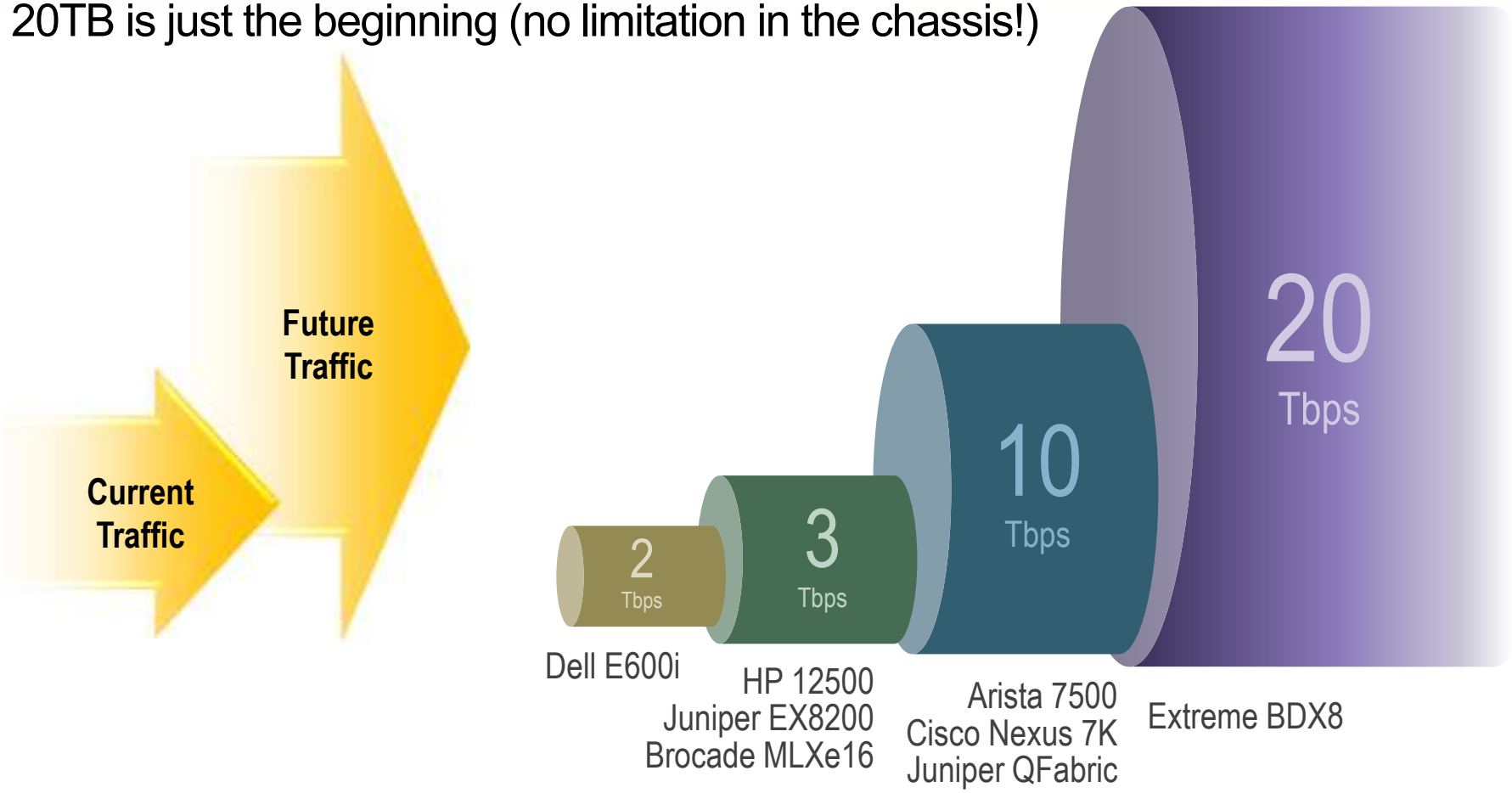
- Direct Connect data path for ultimate performance
- Future-Proof chassis architecture: No mid-data plane design



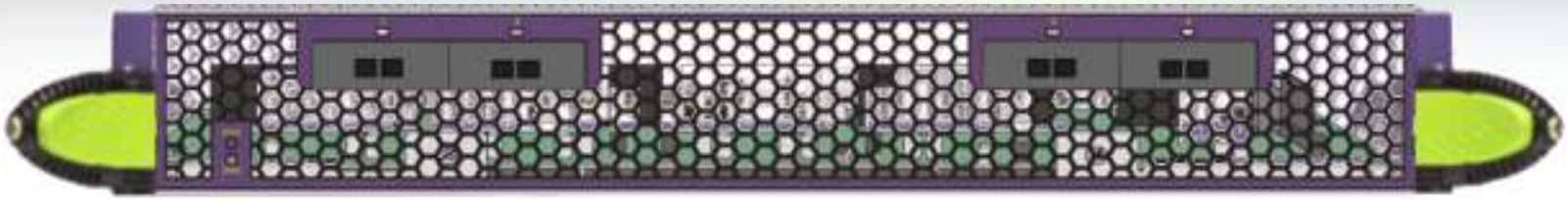
Highest Capacity for Traffic Handling

BlackDiamond X8
Provides Highest Return on Investment!

20TB is just the beginning (no limitation in the chassis!)



BlackDiamond X – 4-Port 100GBaseX-XL Module

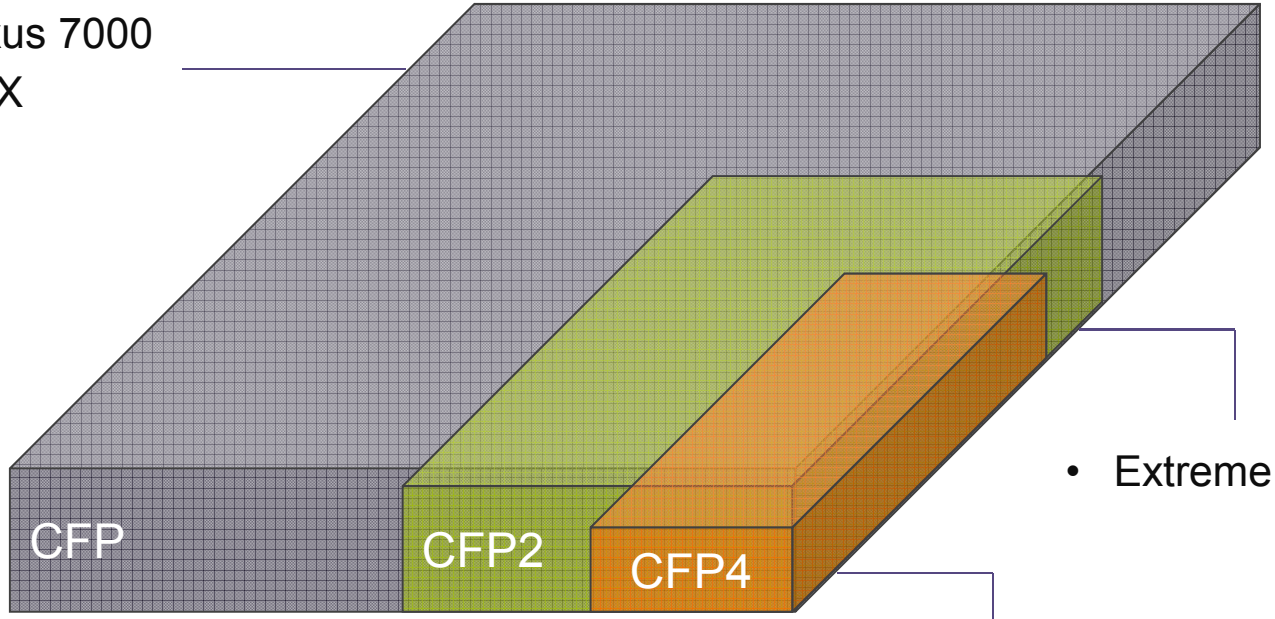


Main Features:

- 4-ports wire-speed 100GbE (CFP2)
- Non-blocking performance
- Choice of 100G-SR (100m) / LR (10Km) optics
- **Large scale 1 Million L2/L3 entries**
- N+1 power support with fully populated chassis
- Supported with 10T and 20T fabrics
- Availability: CY13
- Price: due to the new design it's 1/4 of the current market 100G pricing

100GbE Optics Comparison

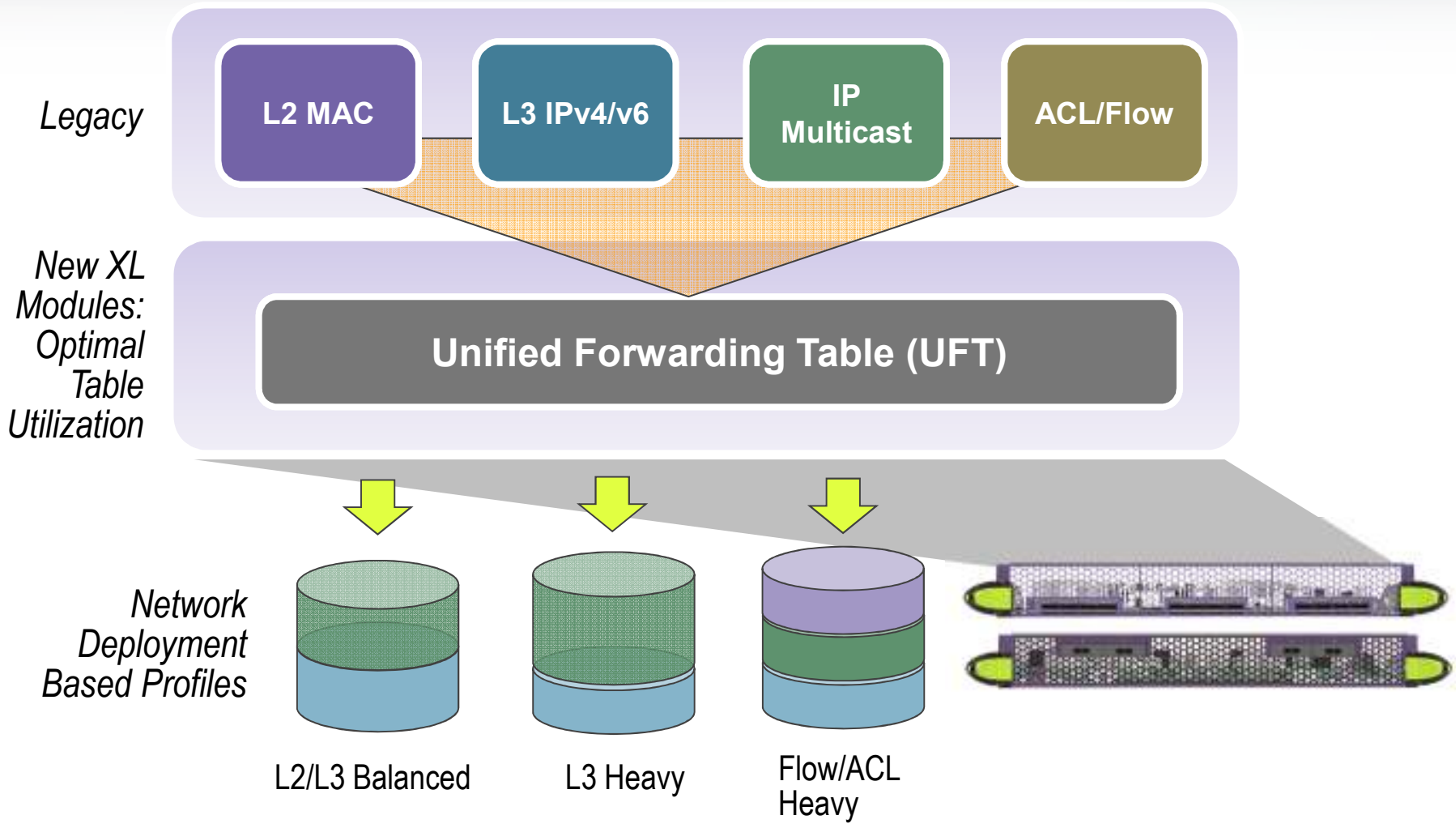
- Cisco Nexus 7000
- Juniper MX



- Extreme BDX

- Late 2014

Unified Forwarding Table: Unprecedented Deployment Flexibility



What is coming to your DC

extreme networks

Expansion of the Ethernet

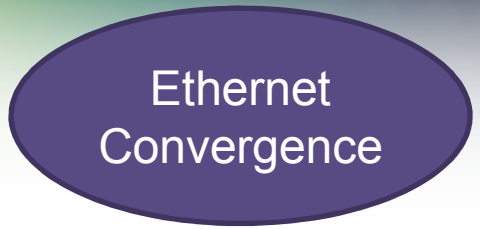
- Ethernet and Infiniband and Fibre Channel
  - Major driver for Fibre Channel is high risk of making changes in existing SAN
  - Major driver for Infiniband is cost/performance
- Metro Ethernet
  - Active expansion of 10Gb aggregation in the metro!
  - Vympelcom Russia – agreement for 48,000 ports of 10Gb in Extreme X670
- Mobile backhauling
  - Replacement of TDM with optical Ethernet
  - Extreme Networks E4G with TDM and Ethernet (SyncE, 1588v2 in HW)
- Audio Video Bridging
  - New wave of standards around AVB
  - Also requires clock synchronization
  - Replacement of the legacy audio interfaces
  - Extreme Networks is the only one supporting AVB in the Enterprise-class switch

What is a Data Center? Barco Digital Operating Room Extreme Networks X670 is in the heart of each room!

- Fully IP-centric solution for image distribution in the operating room. The system architecture has been specifically designed to meet the performance demands and the unique requirements of the surgical suite, such as high-quality imaging, ultra-low latency, and real-time communication.
- Dozens of 10G ports in each room!

BARCO
Visibly yours

Audio Video Bridging (AVB) Overview
Coming to your datacenter!



- AVB networks are used to
  - Support time & bandwidth-sensitive applications
  - Using standard Ethernet while
  - Coexisting with other “legacy” (or non-AV) Ethernet traffic.
- Goal: Synchronization & QoS for multiple streams
  - Voice, video & control.
  - Multiple audio streams for a multi-digital speaker deployment in a large venue.
  - Multiple Video streams in a security surveillance application.
- Applications

Hospitals	Broadcast/production studios
Conference halls	Security and monitoring
Live performance stages	Theme parks
High-end residential AV installations.	Restaurants
Hotels	Airports
Industrial control	Automotive

Properties of AVB Systems

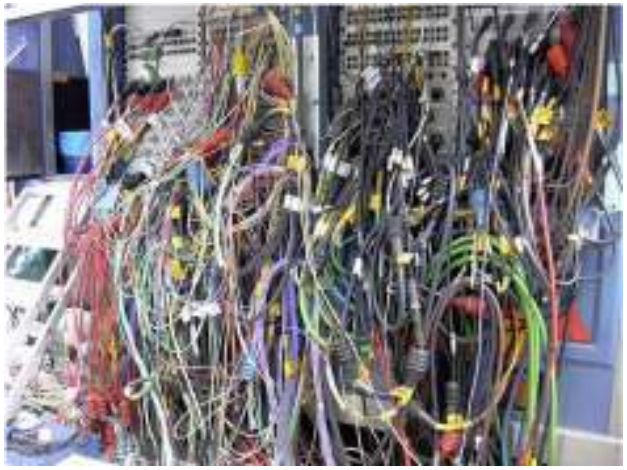
- Time Synchronization
  - It must be possible to synchronize multiple streams with respect to each other.
  - Clocks should be capable of being synchronized to within approximately 1us.

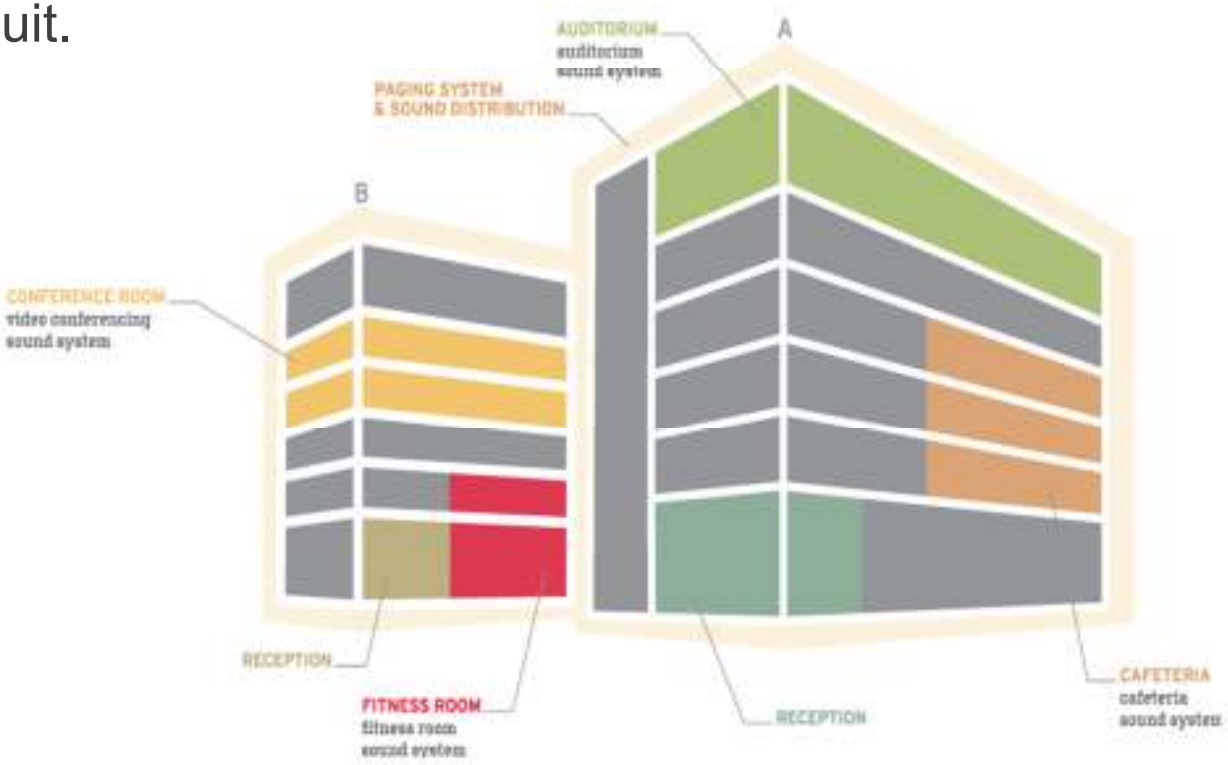
- QoS for AV Streams
  - Domain Detection.
  - Bandwidth Guarantees.
  - Determine, guarantee, and report worst Case Delay Bounds.
    - Prioritization.
    - Traffic Shaping.
    - Protect AVB traffic from non-AVB traffic.

- Network Convergence
  - Allow AV traffic to coexist with other non-AV traffic on the same network.

You can do it without Network Media System

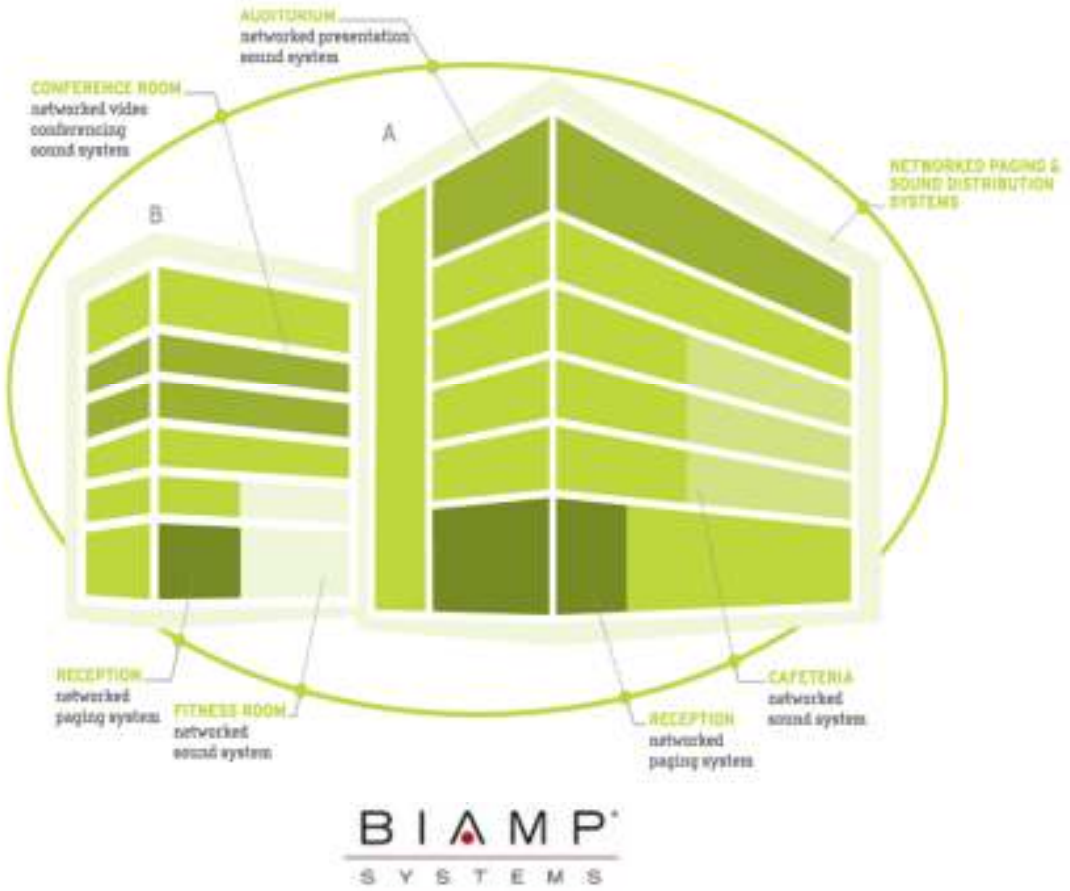
- Diminished DSP resources.
- Greater cost.
- Different software for design and control.
- More training and education.
- Miles of cable and conduit.



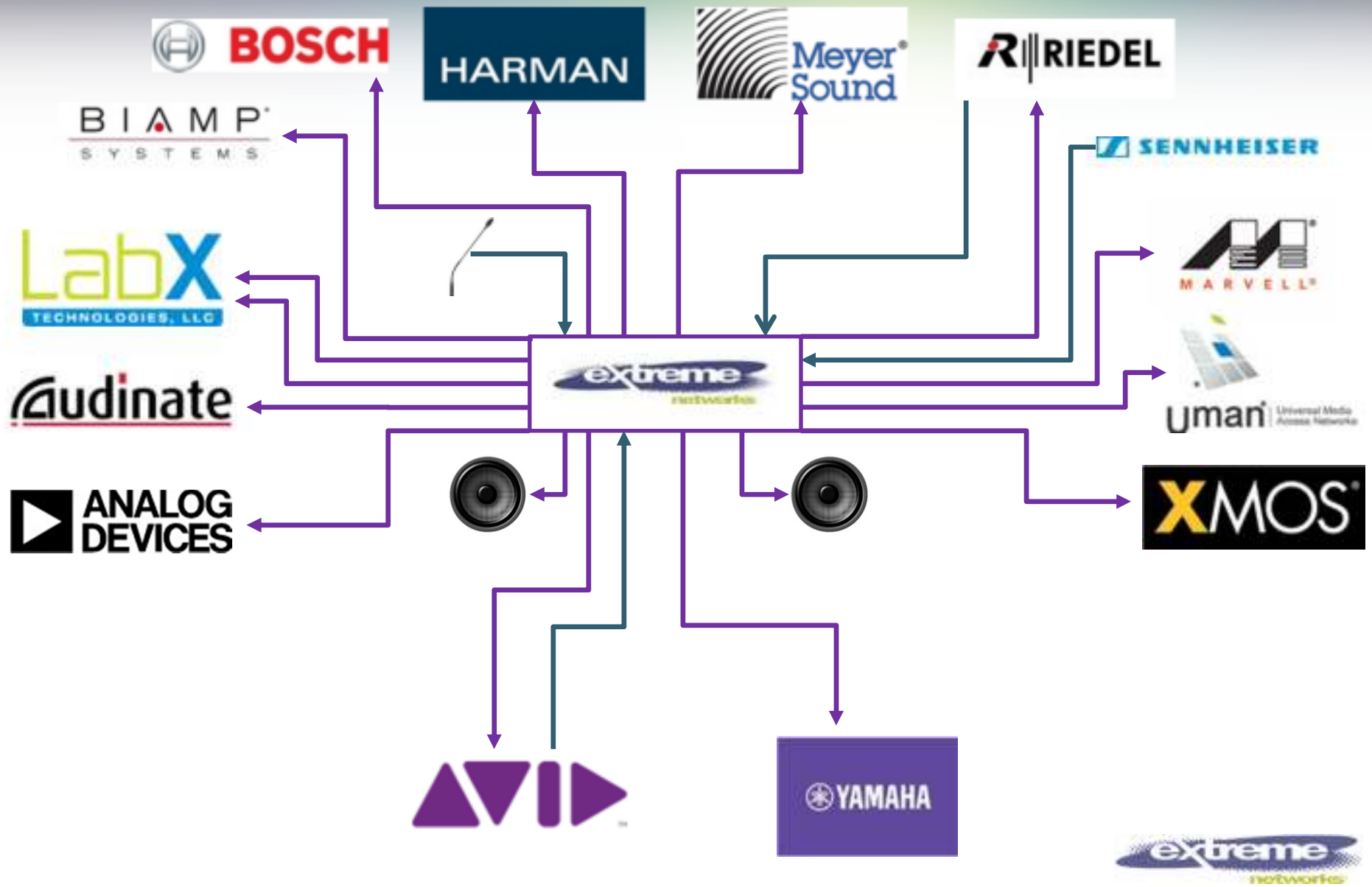


Using Network Media System

- A single platform system operating on a single network.
- Maximized processing resources.
- Control from one central location.
- Efficient expansion to new areas and buildings as you grow.
- Easy to upgrade features and functionality.
- Simplified design, installation and support.
- Greater profitability.



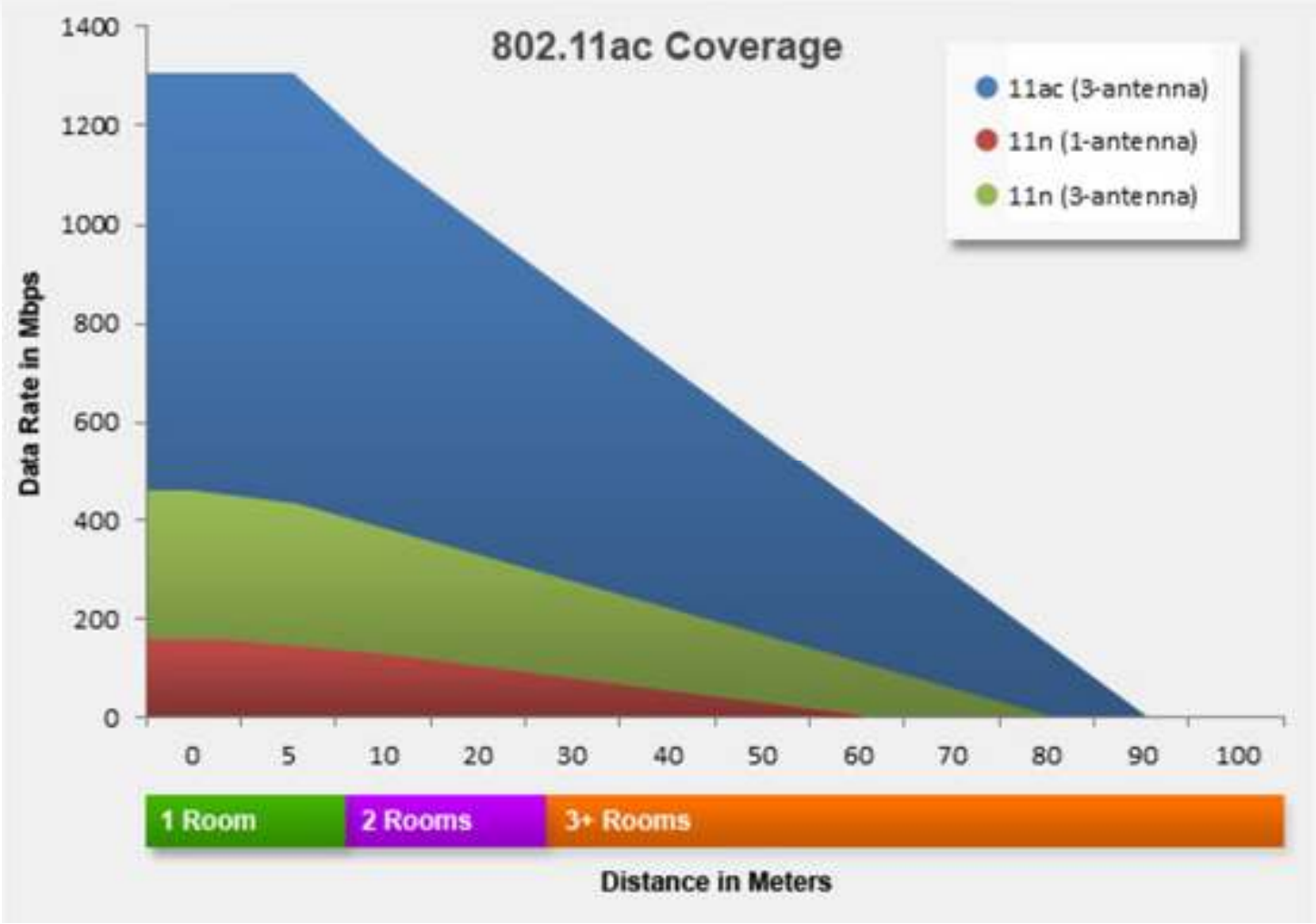
Audio-Video Bridging



Why Audio Video Bridging (AVB)?

- Moving to Ethernet solves cabling issues but:
  - Introduces latency/guaranteed bandwidth and synchronization issues
- AVB
  - Is based on new IEEE Ethernet standards
  - It is open and interoperable so any vendor can support it
  - With AVNU that interoperability is certifiable
- The interoperability test with 15 member companies, including
  - Pro A/V equipment manufacturers Avid, Biamp, Bosch, Harman, Meyer Sound, Riedel Communications, Sennheiser, and Yamaha,
  - network equipment vendor Extreme Networks,
  - platform providers Analog Devices, Audinate, Lab X, Marvell, UMAN, and XMOS.
- **Extreme Networks is now the only Enterprise-class vendor supporting AVB!**

What has WiFi to do with your DC?
802.11ac coverage and throughput



Summary

Extreme Networks Open Fabric and SDN

SDN Applications

- VM Lifecycle Management (XNV)
- User Identity Management (IDM)
- Bring Your Own Device (BYOD)
- Application Performance Management
- Collaborative Programming (XKIT)

Centralized Management/Orchestration Platform

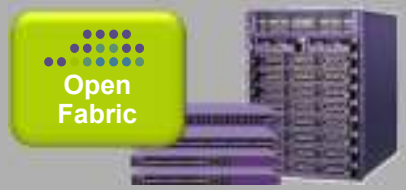
- Ridgeline
- OpenFlow
- openstack

EXOS – Extensible, Open, Secure Network OS

- XML
- Scripts
- External App SDK
- OpenStack Quantum Plugin
- OpenFlow
- Modular
- Predictable Performance
- Memory Protected
- Hardware Abstracted

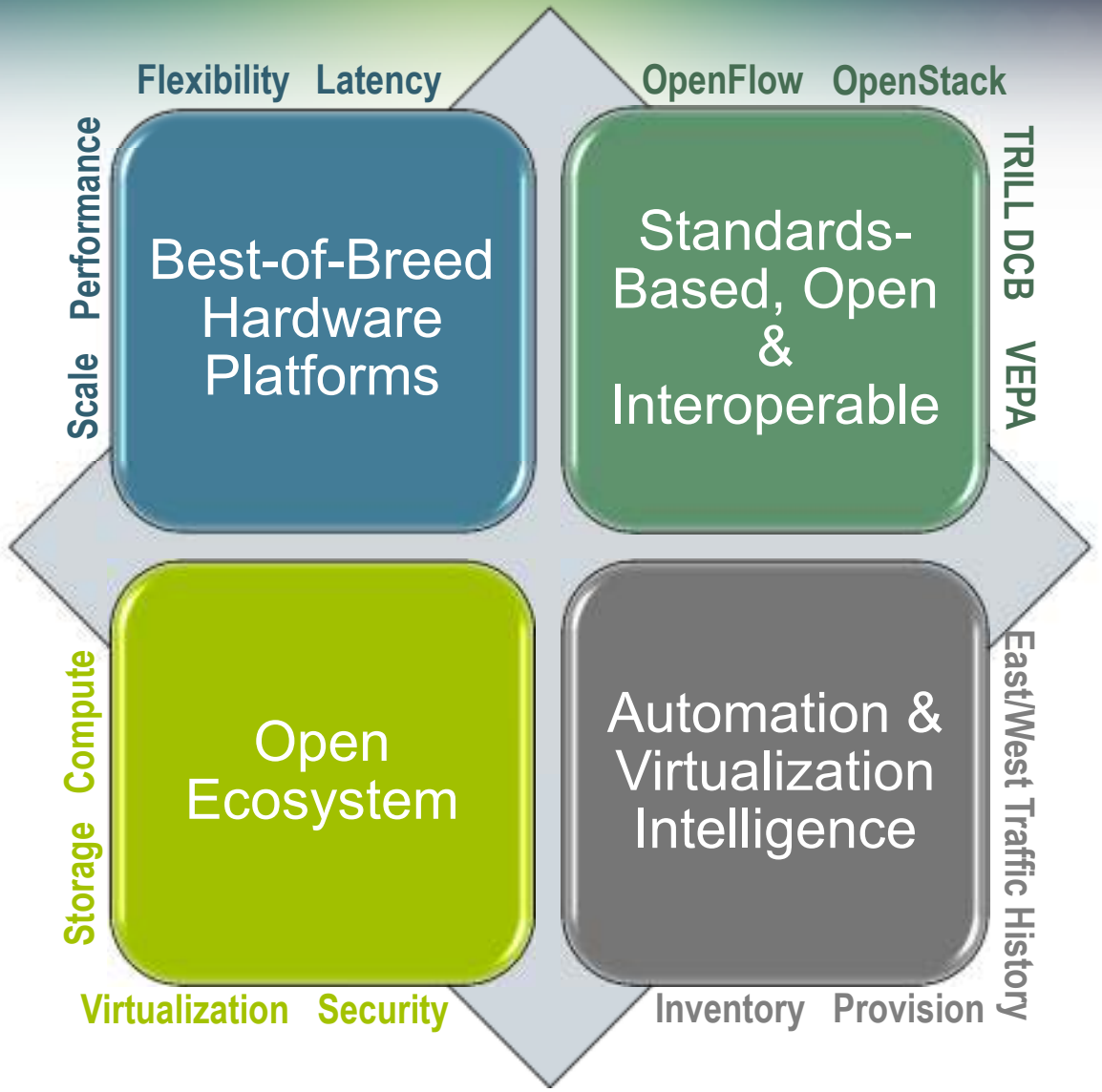
High Performance Converged Open Fabric

- Low Latency
- High Capacity
- MLAG
- DCB



Extreme Networks Open Fabric

A Pragmatic Fabric



Network Technology to Meet Future Demand

Scalable

- Bandwidth aggregation to multiply I/O
- Seamless migration to higher speeds and feeds

Flexible

- I/O diversity and mix-n-match
- Auto-provisioning and configuration

Economical

- Minimal cost increase with speed migrations
- Reusable in terms of infrastructure and training

Reliable

- Is resilient and time tested
- Provides required level of service up time

extreme networks

Thank You!

bgermashev@extremenetworks.com